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Arede, Jorge; Fernandes, John; Moran, Jason; Leite, Nuno; Romero-Rodriguez, Daniel; Madruga-Parera, Marc

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Effects of an integrative neuromuscular training protocol vs. FIFA 11+ on sprint, change of direction performance and inter-limb asymmetries in young soccer players

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Jorge Arede[1], John Fernandes[2], Jason Moran[3], Nuno Leite[1], Daniel Romero-Rodriguez[4,5]; Marc Madruga-Parera[6,7]

[1] Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University of Trás-os-Montes and Alto Douro;
[2] Hartpury University, Gloucester, United Kingdom
[3] University of Essex, Colchester, United Kingdom
[4] International University of Catalonia, Physical Therapy Department, Barcelona, Spain
[5] FC Barcelona First team Sport Performance Area, Barcelona, Spain
[6] University School of Health and Sport (EUSES), University of Girona, Girona, Spain
[7] FC Barcelona, Sports Performance Area, Sport Science Department, Barcelona, Spain

Corresponding Author: Jorge Arede, MSc
Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University of Trás-os-Montes and Alto Douro,
Quinta de Prados, Apartado 202, 5001-911 Vila Real, Portugal;
Phone: +351967585894;
Email: jorge_arede@hotmail.com

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Conflict of Interest

There is no conflict of interest.

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ABSTRACT

This study compared the effects of integrative neuromuscular training (INT) versus FIFA 11+ protocols on sprint, change of direction performance and inter-limb asymmetries. Thirty young (U-11) male soccer players (age: 11.2 ± 0.7 years; height: 145.6 ± 6.8 cm; body mass: 72.5 ± 3.0 kg) were randomly assigned to each training groups, which consisted of two sessions/week for a period of 6-weeks. The INT consisted of play-based tasks designed according to structured training principles, whereas the FIFA 11+ followed standard procedures. Before and after the intervention, 0-20 sprint time and double 180º change of direction test were measured from which change of direction deficit and inter-limb asymmetries were also computed. Significant improvements were found in double 180º change of direction test and deficit for both legs in both groups (all $p < 0.01$). A significant decrease was observed in 0-20 sprint time ($p < 0.05$), and inter-limb asymmetries for FIFA 11+ group. A significant group-by-time effect, which favored the FIFA 11+ group, was observed on double 180º change of direction in right leg (F = 15.08, $p < 0.01$, $\eta^2_p = 0.35$), but also in change of direction deficit in right (F = 214.19, $p < 0.01$, $\eta^2_p = 0.88$), and left legs (F = 126.79, $p < 0.01$, $\eta^2_p = 0.82$). These findings suggest youth soccer practitioners should select the FIFA 11+ program to improve inter-limb asymmetries and 0-20 sprint time, and that both training methods are suitable to improve 180º change of direction performance.

Keywords: children, football, fitness, youth, performance

INTRODUCTION

An effective pathway of long-term athletic development should accommodate the non-linear nature of the growth and development of youth [1]. A variety of factors can impact the development of the youth athlete with the multidimensional nature of sports performance affected by both endogenous and environmental influences. In the last decade, several studies have debated the importance of previous experiences on the subsequent development of young athletes' sports careers [2]. For instance, the role of *early diversification*, based on the notion that children *"sample"* a variety of different sports activities, is considered a suitable pathway to unleash creative decision-making, sport-specific behaviours [3], and all movement competencies [1,2].

Although this discussion often centres on the advantages and disadvantages of early specialization, as opposed to a more eclectic approach focused on early stimulation, consensus is far from being reached. However, a growing body of studies indicate that a diversified and nonspecific sport stimulus adopted in early childhood seems to underpin the development of fundamental movement skills of youth team sports players [1,2]. Moreover, this appears to reduce the incidence of major injuries, also being associated with longer careers than those who participate in a single sport [4]. Thus, it is important to emphasize the correct development of fundamental movement skills in the early years development, establishing optimal levels of neuromuscular coordination [5] to improve participation outcomes throughout the lifespan [6].

Evidence from recent studies supports the use of effective integrative neuromuscular training (INT) programs, focusing on multiple components such as dynamic stability, strength, plyometrics, coordination, speed and agility, and fatigue resistance, to prevent injuries and improve performance [6]. Moreover, the efficacy of the FIFA 11+ program, which was specially developed for children's football (i.e. FIFA 11+ Kids) to reduce injuries [7] and improve performance [8,9] has been confirmed. Several studies have investigated the FIFA 11+ exercise-based injury prevention program in multiple age-groups [10] but, so far, a scarce number of studies have investigated its effect on sprint, change of direction performance and inter-limb asymmetries in children's football. Despite this, some promising results were reported in a randomized controlled trial suggesting that FIFA 11+ program is beneficial for vertical jump, change-of-direction speed and static plank times in 9-11 year-old female soccer players [11]. The current lack of longitudinal and well-controlled empirical studies limits the comprehensive understanding of the training process in youth, the manner how long-term approaches to athletic development influence physical performance, health and well-being and injury risk.

A new training method, called structured training, has been proposed specifically to generate adaptations according to the interchangeable demands of team sports, and respecting the different identifiable structures in performance in team sports players (for example, bioenergetics, cognitive, coordinative, conditional, creative, socio-affective, emotional-volitional, and mental) to promote the integral development of the athlete [12]. The implementation of a game-based intervention with structured training principles might be an intriguing alternative to the FIFA 11+, in the youth population, especially given the low levels of enjoyment that it is associated with [11]. Moreover, the use and modification of standardized exercise-based protocols (e.g., FIFA 11+) occurs frequently in youth soccer population, adapting to ability levels of individual players [13]. The structured training has been widely used in the practical field, and there is promising evidence of beneficial effects of training programs based on their principles [14], but more studies are needed to better understand its effect, particularly the application of its principles in INT programs.

The aim of this study was to compare the effects of 6 weeks of integrative neuromuscular warm-up and FIFA 11+ program on sprint, change of direction performance and inter-limb asymmetries in young soccer players. Due to the lack of comparable report, we propose the null hypothesis i.e., that there will be no difference in the efficacy of the INT and FIFA 11+ programs.

MATERIAL AND METHODS

Participants

Thirty young (U-11) male soccer players (age: 11.15 ± 0.66 years; height: 145.55 ± 6.78 cm; body mass: 72.52 ± 2.96 kg) volunteered to participate in this study. No somatic maturation data is provided, because the most used indicator of the somatic maturation (i.e., assessment of the years from/to the peak height velocity) has effective applicability after 12 years old [15]. All players participated in an average of five hours of soccer training, and 1 competitive match (regional level) per week. The eligibility criteria of the study were: 1) injury free in the last 6 months, 2) a commitment to attend 80% of scheduled training sessions, 3) a commitment to attend all assessment sessions. Written informed consent was obtained from all participants' parents and player assent was obtained before the beginning of the investigation. The present study was approved by the institutional research ethics committee Catalan Sports Council Ethics Committee (07/2017/CEICGC) and conformed to the Declaration of Helsinki.

Procedures

A pre-post parallel group trial was undertaken. Subjects were randomly assigned to two experimental groups: integrated neuromuscular training (INT, n = 15) or FIFA 11+ warm-up protocol training groups (n = 15). The training period lasted six weeks and was carried out twice a week in addition to the regular soccer training sessions (n = 12). Before the commencement of the study, a reliability analysis of the physical tests employed in the present investigation was made with all the participants in the study. Testing sessions were performed 1 and 2 weeks before the commencement of the training period (i.e., pretest) and 1 week after the intervention (i.e., post-test).

Training intervention

Subjects in both groups (INT vs FIFA 11+) performed two weekly training sessions during the 6-weeks intervention period. The INT training protocol designed according structured training principles consisted of four play-based tasks (five minutes per task) which aimed to develop the different components of INT programs such as dynamic stability, coordination, strength, plyometric training, and speed/agility [6] (Table 1 and Figure 1). The FIFA 11+ training protocol consisted of 15 different exercises: six running exercises, three exercises targeting body stability, two strength exercise, one jumping exercise, and three running exercises [11,16]. The program has a modular structure and consists of three skill levels with load progressively added. The participants started the FIFA 11+ at level one for the first 2 weeks, completed the level two in the following

2 weeks and finished the intervention at level three. Each training program was supervised by a distinct qualified fitness coach. During the FIFA 11+ training program, the fitness coach provided internal focus feedback related to sprinting and change of direction technique. The INT group received verbal encouragement (e.g., “let’s go”, “keep going”, etc.) and mainly positive feedback, encouraging decision-making (e.g., “find the empty space”, “find the best options”). Main researcher encouraged each fitness coach to administer training sessions according to the defined protocol.

*** *Insert Table 1 Here****

*** *Insert Figure 1 Here****

Measurements

The physical performance tests were performed under the same environmental conditions (training session time, outdoors soccer field, and late spring) with verbal encouragement. No wind or rain was present during testing sessions. Tests were performed in a standardized order: anthropometrical measurements, straight sprinting tests (0-20 m splits time), and double 180° COD test. Dual beam electronic timing gates (*Witty, Microgate, Bolzano, Italy*) positioned at a height of 90 cm, separated by 1.5 m were used to record running and change-of-direction speed times. Each participant performed two sprints, and change-of-direction speed with two minutes of rest between trials. They started each speed, and change-of-direction speed test in a standing position with their feet 0.3 m behind the first timing gate. The best of two trials was recorded for each distance and used in the analyses.

Speed test (20 meters)

The running speed was evaluated by 20-meters (0–20 m) split time.

The double 180º COD test

The participant was in the middle of a 1.5 m lane, with one foot slightly ahead of the other. Each participant was instructed to run to a mark situated 7.5 m from the starting line, perform a 180° COD using the dominant leg to push off, return to a mark 5 m away, perform another 180° using the dominant leg to push off, and continue running past the final mark situated 7.5 m away, covering a total of 20 m [17]. The lower limb asymmetry index (ASI) was determined adhering to the procedures of Bishop and colleagues [18] using the following formula: *ASI = 100/Max Value (right and left) x Min Value (right and left) x – 1 + 100*. The COD deficit for the double 180° COD test for each leg was calculated via the formula: mean double 180° COD time – mean 20 m time [19].

Statistical analysis

Within-session reliability of test measures computed using an average measures two-way random intraclass correlation coefficient (ICC) with absolute agreement, inclusive of 95% confidence intervals, and the coefficient of variation (CV). The ICC was interpreted as follows: poor (< 0.5), moderate (0.5–0.74), good (0.75–0.9), and excellent (>0.9) [20]. Coefficient of variation values were considered acceptable if < 10% [21].. Data are presented as mean ± SD. Normality of data distribution and sphericity were confirmed using the Shapiro-Wilk statistic and Levene's Test for equality of variances, respectively. The independent samples t-test was used to compare the groups at baseline. Also, a paired-samples t-test was used to analyze within-group changes. A 2x2 mixed model analysis of variance (ANOVA) was performed on the absolute values of all parameters to determine the main effects between groups (FIFA 11+, and INT) and time (pre, and post-test). The threshold values for Cohen's *d* for effect sizes (ES) statistics were 0–0.2 trivial, >0.2–0.6 small, >0.6–1.2 moderate, >1.2–2.0 large, and >2.0 very large [22]. The partial eta-squared (η^2_p) values were interpreted as no effect ($\eta^2_p < 0.04$), minimum effect ($0.04 < \eta^2_p < 0.25$), moderate effect ($0.25 < \eta^2_p < 0.64$), and strong effect ($\eta^2_p > 0.64$) [23]. All the statistical analyses were performed using JASP software (version 0.13, *University of Amsterdam*, *Netherlands*).

RESULTS

All ICC values ranged from moderate to excellent (ICC range = 0.66-0.99) and all CV values were acceptable (CV range = 2.92-3.25%) (Table 2).

**** Insert Table 2 Here****

Data from 0-20m, $COD180_L$, and $COD180_R$ were comparable between the two groups at baseline (all $p > 0.05$; see Table 3). The INT group significantly improved $COD180_L$ ($p < 0.0001$, ES = 1.49), $COD180_R$ ($p < 0.01$, ES = 0.80), $CODD_L$ ($p < 0.0001$, ES = 1.15), and $CODD_R$ ($p < 0.01$, ES = 0.83) performance. Similarly, in the FIFA 11+ group, 0-20m ($p < 0.05$, ES = 0.56), $COD180_L$ ($p < 0.0001$, ES = 1.44), $COD180_R$ ($p < 0.0001$, ES = 3.10), $CODD_L$ ($p < 0.0001$, ES = 5.21), $CODD_R$ ($p < 0.0001$, ES = 7.98), COD_{ASY} ($p < 0.05$, ES = -0.58), $CODD_{ASY}$ ($p < 0.01$, ES = -1.03), performance were all improved after the intervention.

**** Insert Table 3 Here****

The statistical analyses showed a significant main effect of time in $COD180_L$ ($p < 0.0001$; η^2_p = 0.62), $COD180_R$ ($p < 0.0001$; η^2_p = 0.67), $CODD_L$ ($p < 0.0001$; η^2_p = 0.89), and $CODD_R$ ($p < 0.0001$; η^2_p = 0.93) (Table 4). There was a significant effect of group in $CODD_L$ (p < 0.0001; η^2_p = 0.53), $CODD_R$ ($p < 0.0001$; η^2_p = 0.65), and $CODD_{ASY}$ ($p < 0.05$; η^2_p = 0.13) (Table 4). Finally, there was a significant interaction effect (group x time) in 0-20m ($p < 0.05$; η^2_p = 0.13), $COD180_R$ ($p < 0.0001$; η^2_p = 0.37), $CODD_L$ ($p < 0.0001$; η^2_p = 0.73), and $CODD_R$ ($p < 0.0001$; η^2_p = 0.86) with the FIFA 11+ group demonstrating greater improvements (Table 4).

*** *Insert Table 4 Here****

DISCUSSION

The aim of this study was to compare the efficacy of an integrated neuromuscular training program on sprint performance, change of direction ability and inter-limb asymmetries in young soccer players compared to the FIFA 11+ program. We found that both training programs were effective for improving COD performance and decreasing the CODD. Moreover, the FIFA 11+ was effective in reducing the inter-limb asymmetries (COD and CODD) and 0-20 sprint time. Practically, these data would suggest coaches working with young soccer players should select the FIFA 11+ program when looking to improve physical parameters.

This study observed a positive effect of the FIFA 11+ program on 0-20 sprint time which is in line with previous reports [8,9,24,25]. Moreover, the present results seem to be more encouraging than previous studies using the same protocol [16,26] possibly because of the nature of stimulus that coincided with the natural adaptive response of the youth soccer players resulting from growth and maturation [27]. In fact, a previous study demonstrated that plyometric training was particularly effective to improve short-to-medium sprinting times (< 20 m) over other training methods, in pre-peak height velocity athletes [27]. It could be suggested that the high neural demand of plyometric training (e.g., countermovement jump for maximum height, and double-leg hops in different directions) included in FIFA 11+ provided a stimulus matching with proliferation in neural coordination and central nervous system maturation experienced during pre-pubescence [27]. After the plyometric training, sprint training is the most effective training method for improving sprint times in pre-peak height velocity participants [28]. The FIFA 11+ protocol included sprinting-based activities, such as 40-meters at 75-80% of maximum speed, which involve performing movements that use the stretch-shortening cycle (SSC), which might improve an individual's rate of force development, impulse generation and muscle stiffness which are neurophysiological adaptations associated with optimized sprint performance [29]. Thus, the youth athletes who participated in FIFA 11+ benefited, not from neurophysiological adaptations, but also from the dynamic correspondence (i.e., horizontal force production vector) of the imposed task with the selected outcome measure, to achieve better performance. However, the previous most promising results, including early soccer adolescents, involved integrative neuromuscular strength training comprised of resistance-based activities (i.e., knee and hip dominant exercises) performed through the use of free weights [24]. This means that young athletes can benefit from overloading the musculature of hip and knee regions involved during the SSC resulting in higher lower-body strength [30], and consequently in improved performance over short-to-medium sprinting distances (< 20 m) [29]. Nevertheless, FIFA 11+ imposes a systematic use of exercises that only contemplate light or absence of load, may generate a different adaptive response, because of an insufficient stimulus to increase a neural drive [29], and consequently to obtain substantial gains over short distances. Furthermore, the present INT training protocol based on play-based tasks failed to exhibit significant improvements in 0-20m sprint time. Considering the previous arguments, it seems evident that the short-term use of play-based tasks is insufficient to generate adaptations that result in an optimized sprinting time.

The current training programs elicited significant improvements in the COD180 test. The comparable improvements in COD performance between these two programs might be owing to similar activities in the programs i.e., jump type activities. Indeed, the 180º change of direction involves high peak muscle activity of the knee stabilizers (vastus medialis and lateralis) which play a key role in frontal play control [31]. Moreover, the peak activity of these muscles was similar when the same subjects performed distinct type of jumps (i.e. vertical and horizontal directions, bilateral and unilateral) [31]. In the present study, both training programs, imposed these types of jumps, but also distinct types of changes-of-directions. Regardless of these differences, chronic exposure to such movement patterns can generate an improvement in the activation of the aforementioned muscles, which may result in a positive transfer to the COD180 in a controlled setting. The fastest performance in 180º change of direction involves significantly higher braking and propulsive forces (particularly horizontal) on the final foot contact [32,33]. The improvement of motor performance in pre-adolescents occurs mainly due to neural adaptations, such as increases in motor unit activation and synchronization, as well as enhanced motor unit recruitment and firing frequency, fundamental for high-velocity actions [29]. In this way, the two training programs provide situations that involve high-velocity concentric and eccentric contractions (e.g. starts, sprints, jumps, and landings) that may have resulted in the improvement of horizontal propulsive forces and breaking capacity, respectively [29]. Nevertheless, the players executing the FIFA 11+ demonstrated greater improvement than their counterparts in $COD180_R$. This can be partially explained because youth athletes respond effectively to a combination of stimuli of different components (e.g., strength, plyometrics, speed, agility, etc.) [6,29]. In this regard, literature [29] suggests that the involvement of exercises in a controlled environment as in the FIFA 11+ protocol (e.g., body weight exercises, box jumps, and landings) is recommended for the development of change of direction speed in novice athletes, and in particular for the improvement of isometric and eccentric strength capacities associated with the fastest performance in 180º change of direction speed test [33].

The CODD has been proposed as a practical measure to isolate COD ability independent of sprint speed [19]. The present results indicate that six weeks of FIFA 11+ and INT resulted in significant decrease in CODD. The chronic exposure to multi-directional (horizontal and vertical) and unilateral activities (e.g. jumps), can result in improvements in COD ability [34]. Both FIFA 11+ and play-based INT included these types of activities with different types of muscle actions (i.e., concentric, eccentric and isometric), which may have contributed decisively to the improvement of unilateral reactive and isometric strength, jumping height and length, significantly negative correlated with CODD [34]. However, more studies are warranted for better understanding of underlying mechanisms.

Finally, standardized exercise-based protocols, such as FIFA 11+ have been effective to improve motor performance in youth soccer players, but the enjoyment of completing the program is low [11]. Therefore, practitioners should be aware that low enthusiasm for the program could have long term adherence implications, which consequently impair the long-term athlete development [11]. Engaging in athletic development programs that promote both physical fitness and psychosocial wellbeing, it is paramount to counteract the risk of an over-structured and invariable training environment, that are commonly associated with overuse injuries, burnout, decreased motivation, and limited long-term physical activity participation [1].

Despite the usefulness of present findings, the present study has some limitations which must be acknowledged. First, only a small sample size was involved. Secondly, the study was only carried out for a short period of time (6 weeks) which may help explain the low effectiveness of the INT protocol. Future studies with a longer intervention period are mandatory to better understand the effects of this training method. Moreover, it would be interesting to analyze the effect of training based on structured training principles at cognitive, coordinative, creative, socio-affective, emotional-volitional, and mental levels. However, given the current lack of knowledge regarding the effects of play-based INT protocol in youth athletes, this study provides an important addition to this field.

CONCLUSIONS

This study sought to determine the efficacy of an integrated neuromuscular training program on sprint performance, change of direction ability and inter-limb asymmetries in young soccer players compared to the FIFA 11+ program. Though both programs improved markers of change of direction ability, the FIFA 11+ additionally reduced sprint time and inter-limb asymmetries. The superior improvements in the FIFA 11+ program compared to the integrated neuromuscular training program is likely owing to the specific activities within the program. Accordingly, coaches should opt for the FIFA 11+ program when seeking to improve sprint performance, change of direction and inter-limb asymmetries in young soccer players.

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Table 1. Integrative neuromuscular training tasks designed according structured training principles.

Week	**Task 1**	**Task 2**	**Task 3**	**Task 4**
1	***A. Plank and relay races***	***B. Throwing Back duel***	***C. Plank match***	***D. Steal tail***
	Start in front plank position and sprint for a relay race. 1 set x 3 repetitions.	In pairs, stand back to back, at the signal turn and throw the ball to the opponent. 2 sets x 8 repetitions.	Pairs in front plank position, perform 1 vs 1 in small space. 3 sets x 40 seconds.	In group of three, all against all, chase and steal tails. 1 set x 8 repetitions.
2	***E. Match carrying a swiss ball***	***F. Jump perturbations and sprint***	***G. Fight for the ball***	***H. Unilateral Jump and 1vs1***
	Small sided game (4v4; 12 x 12 m) with mini goals. Each player carries a swiss ball and can contact the opponent. 1 set x 50 seconds.	In pairs, they perform the jump bilateral and unilateral with the possibility of pushing the opponent into the air. After landing, they perform a sprint. 2 sets x 8 repetitions.	In pairs, one athlete must reach the ball placed on the floor and another tries to protect it. 4 sets x 30 seconds.	Unilateral jump in the lateral direction over the mini goal, followed by a sprint, trying to reach the ball before the opponent, to shoot. 1 set x 8 repetitions.
3	***I. Fight and Pull the ball***	***J. Balance on the ball***	***K. Sit match***	***L. Team Race circle***
	In pairs, sitting on the floor, they pull the soccer ball until someone gets it. 3 sets x 20 seconds.	The athlete tries to balance with both feet on a soccer ball as long as possible. During his stance on the ball, his teammates make passes with his hands. 2 sets x 8 repetitions.	Small sided game (4v4; 12 x 12 m) with mini goals. Each player plays sitting on the floor. 3 sets x 60 seconds.	Three teams. Each athlete performs an x meter sprint and tries to place the flag on the target before the other team member. If not, you should go back and pass the turn to the colleague. The team that places all the flags on the target first wins. 3 sets x 30 seconds.
4	***M. Plank relay jump races***	***N. Cross the wall***	***O. 1vs1***	***P. Battle 4 corners***
	Relay races in front plank position and jumping over the partner. 1 set x 3 repetitions.	Two players are placed protecting an area, the rest of the players must reach that area, without being touched. 1 set x 3 repetitions.	1vs1 match in a small court. 4 sets x 30 seconds.	Twelve balls are placed in a central square. Four players compete against each other. They try to move the balls from the central square to their corner. 4 sets x 30 seconds.
5	***Q. Plank match with a cone on the back***	***R. Plank Relay Races and driving the ball zigzagging***	***S. The tower***	***T. Unilateral balance shooting***
	1vs1 match in front plank position, holding a cone on back. 4 sets x 30 seconds.	Relay races with players in side plank position and driving the ball. 1 set x 3 repetitions.	Two teams use hand passes to get the ball to the tower (a player located outside the playing area). 3 sets x 30 seconds.	In pairs, the player in unilateral stand position try score a goal for the goalkeeper kneeling on the ground. 2 sets x 8 repetitions.
6	***U. The crane***	***V. Kangaroo duel***	***X. Roulette***	***W. Crazy match***

	In pairs, one player helps teammate to rescue balls from an area, without invading the bounded space. 3 sets x 30 seconds.	In pairs, players compete against each other, first jump and go for the ball quickly to start the 1vs1. 2 sets x 8 repetitions.	Competition scoring goal with the head. 2 sets x 8 repetitions.	Possession small sided game (4v4; 12 x 12 m) with triangular ball. 4 set x 60 seconds.

Table 2. Reliability data for test variables.

Test Variables	ICC (95%CL)	CV (%) (95%CL)
0-20 m	0.99 (0.79; 0.95)	2.92 (2.11; 3.77)
COD_R	0.73 (0.43; 0.87)	3.06 (2.03; 4.43)
COD_L	0.66 (0.29; 0.84)	3.25 (2.22; 4.48)

Abbreviations: ICC = Intraclass correlation coefficient; CV = Coefficient of variation; CL = Confidence limits; CMJ = Countermovement jump height; 0-10 m = 0-10 m sprint time; 0-25 m = 0-25 m sprint time; HJ = horizontal jump; R = Right; L = Left.

Table 3. Inferences of the training programs intervention on player's performance measures.

Variables		**Pretest, mean±SD**	**Postest, mean±SD**	***p***	**Effect size**	**Between-groups pretest differences (*p*)**	**Effect size**
0-20m (s)	INT	3.97±0.33	4.01±0.39	0.590	-0.16	0.101	0.62
	FIFA	3.80±0.22	3.69±0.16	0.048	0.56		
$COD180_L$ (s)	INT	6.35±0.33	6.04±0.32	0.000	1.49	0.197	0.48
	FIFA	6.19±0.34	5.77±0.19	0.000	1.44		
$COD180_R$ (s)	INT	6.30±0.43	6.07±0.37	0.008	0.80	0.401	0.31
	FIFA	6.18±0.32	5.61±0.21	0.000	3.10		
$CODD_L$ (s)	INT	2.38±0.35	2.04±0.32	0.000	1.15	0.000	-4.18
	FIFA	3.65±0.25	2.08±0.15	0.000	5.21		
$CODD_R$ (s)	INT	2.33±0.26	2.06±0.28	0.006	0.83	0.000	-5.63
	FIFA	3.65±0.21	1.93±0.19	0.000	7.98		
COD_{ASY} (%)	INT	3.65±3.21	3.31±2.78	0.796	-0.07	0.088	0.646
	FIFA	2.00±1.63	3.64±1.97	0.043	-0.58		
$CODD_{ASY}$ (%)	INT	9.15±7.06	9.73±8.45	0.864	0.45	0.006	1.09
	FIFA	3.35±2.70	9.96±5.20	0.001	-1.03		

Table 4. Summary of 2x2 mixed-model analysis of variance for the performance scores

Variable	F_{TIME}	η^2_p	p	F_{GROUP}	η^2_p	p	$F_{TIME\ X\ GROUP}$	η^2_p	p
0-20m	0.98	0.03	0.330	6.25	0.18	0.019	3.63	0.12	0.067
$COD180_L$ (s)	62.01	0.69	0.000	4.77	0.15	0.038	1.54	0.05	0.226
$COD180_R$ (s)	82.35	0.75	0.000	6.05	0.18	0.020	15.08	0.35	0.001
$CODD_L$ (s)	306.11	0.92	0.000	58.92	0.68	0.000	126.79	0.82	0.000
$CODD_R$ (s)	398.43	0.93	0.000	71.13	0.72	0.000	214.19	0.88	0.000
COD_{ASY} (%)	0.78	0.03	0.385	1.57	0.05	0.220	1.80	0.06	0.191
$CODD_{ASY}$ (%)	3.74	0.11	0.063	4.46	0.14	0.044	2.63	0.09	0.116

Abbreviations: The partial eta squared values should be interpreted as no effect ($\eta^2_p < 0.04$), minimum effect ($0.04 < \eta^2_p < 0.25$), moderate effect ($0.25 < \eta^2_p < 0.64$), and strong effect ($\eta^2_p > 0.64$).

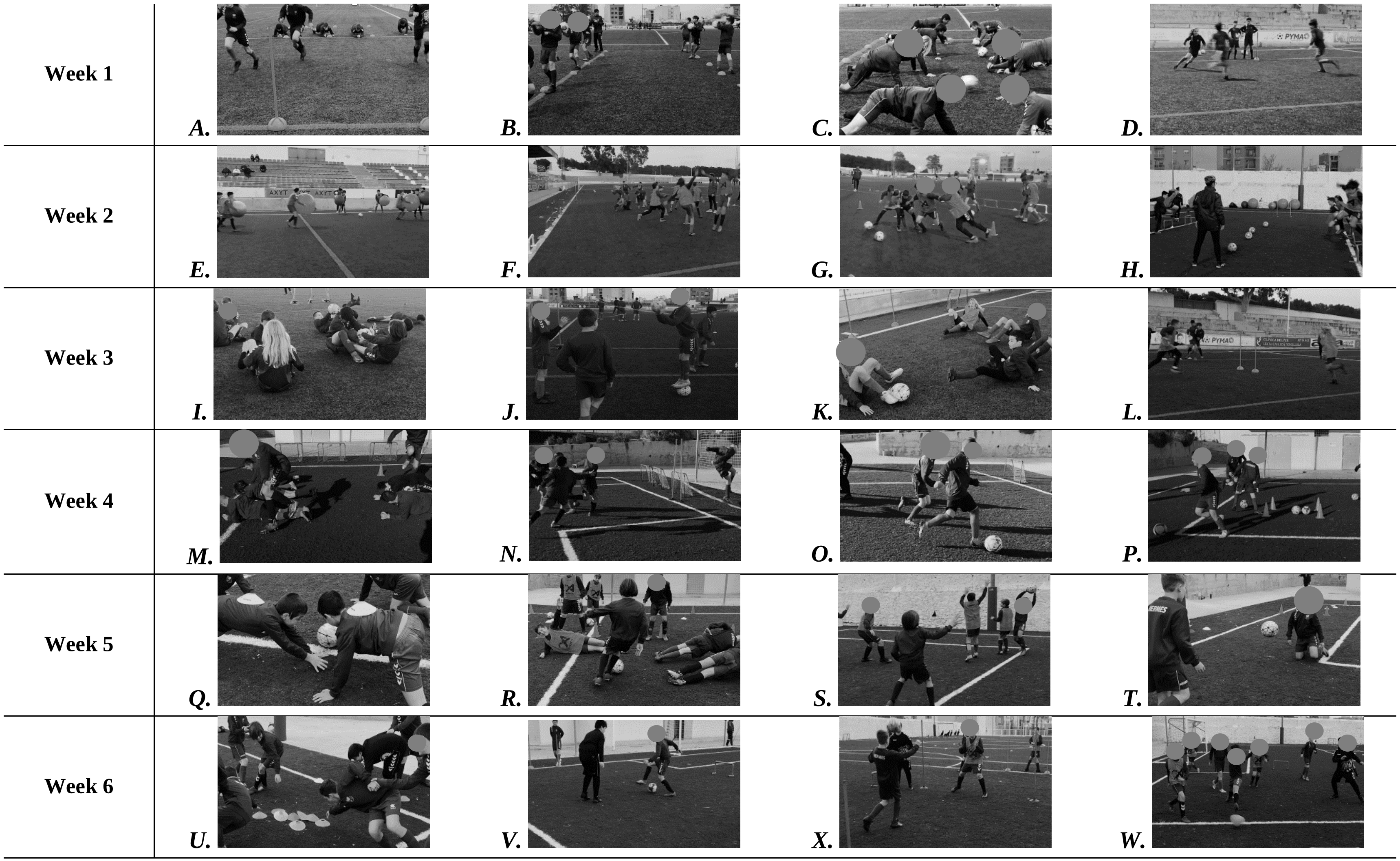

Figure 1. Integrative neuromuscular training tasks designed according structured training principles. Note: Abbreviations of each exercise are displayed in Table 1.